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Early results bode well for new Groundwater treatability test

Fluor Hanford's Groundwater Remediation (GRP) Project is testing a new and innovative system to treat and clean groundwater in the 100-K Area. The 100-KR-4 treatability test started June 28 and has already cut levels of chromium-VI by more than 75-percent in the groundwater at the test site.

Large plumes of chromium-VI, technically known as hexavalent chromium, in the groundwater have plagued Hanford's 100 Areas since defense-production reactors operated there during the 1940s-1980s. Sodium dichromate, containing chromium-VI at a concentration of 700 parts per billion (ppb), was added to cooling water pumped through the reactors to inhibit corrosion. After use in the reactors, the cooling water was held briefly in retention basins, cribs and trenches and then pumped back to the Columbia River. These holding areas leaked and failed, contaminating the groundwater and river shore of the 100 Areas.

The 100-KR-4 test system consists of an extraction well (199-K-126) approximately 100 feet deep, surrounded in circular fashion by four injection wells located approximately 100 feet away from it. All of the five wells in the test system have wire-wrapped screen providing tiny holes in the bottom areas where they interact with the groundwater.

In the treatment process, groundwater is pumped out through well 199-K-126, then mixed with calcium polysulfide in an above-ground tank, and re-introduced into the aquifer through the four injection wells. The calcium polysulfide causes a chemical reaction with the chromium-VI, reducing it to chromium-III (trivalent chromium), some of which precipitates in the mixing tank. The treated water is then filtered and re-introduced into the aquifer through the four injection wells.

Chromium-III is much less soluble and less toxic in water than chromium-VI, which means that it cannot be ingested through water by living organisms such as fish and humans. Essentially then, changing chromium-VI to chromium-III

renders the chromium nearly harmless to these organisms. Chromium-VI is a carcinogen, or cancer-causing agent. Reducing chromium-VI to chromium-III has been the goal of other groundwater treatment systems in the 100 Areas, including pump-and-treat systems and an underground "in situ redox manipulation barrier" in the 100-D Area.

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Ron Jackson, GRP

GRP Photos



The 100-KR-4 CPS Treatability Test is shown during startup on June 28.

The new calcium polysulfide system seems to be working exceptionally well. According to Ron Jackson, Fluor Hanford project manager, data collected in the first two weeks of the test's operation have reduced chromium-VI concentrations from about 70 ppb in groundwater at the bottom of the extraction well, to less than 10 ppb in groundwater at the test site. The drinking water standard established by the U.S. Environmental Protection Agency (EPA) for chromium-VI is 100 ppb. The aquatic standard, designed to protect fish habitat, is even lower at 11 ppb.

Jackson said the 100-KR-4 test was conceived after an expert panel recommended that Fluor Hanford develop some innovative methods to remediate the groundwater under the 100 Areas. Several key members of the GRP Project team then worked together cooperatively. Scott Petersen developed the scientific basis behind the plan and Jerry Isaacs and his group produced the engineering and implementation plan. Crews managed by Chris



Reactor effluent discharges saturated the groundwater of the 100-K Area with chromium-VI, in 1962.

Wright drilled the wells needed for the test, and Vern Johnson coor-

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minated the early program planning.

"This test plan was developed and implemented very quickly," Jackson said. "Everyone on the team was proactive, with the result that the concept was developed, approved by DOE and EPA, the wells drilled, and the test underway all within eight months. We're very proud of moving this fast to try a new method to protect the valuable fish and environment of the Hanford Reach."

Some scientific and physical obstacles have yet to be overcome. "The more heterogeneous the sub-strata, the more time it will take to treat all of the chromium-VI. In other words, if the underground mobility of the water is high, it will take longer to clean up the area," Jackson explained. In addition, some of the water re-injected into the ground has shown lower concentrations of oxygen than desirable for fish. The hypo-oxygenation issue may not be a problem because, in the current test, the injection wells are located several hundred feet from the Columbia River. Natural groundwater flow should cause the water to be re-oxygenated by the time it reaches the river. However, the hypo-oxygenation issues will be carefully

GRP Photos



The KR-4 Treatability Test equipment skid is pictured during delivery to the test site (left photo). The test skid, settling tank and safety shower (from left to right) are in place in the 100 K Area (right photo).

considered in any subsequent use of this technology.

The 100-KR-4 test well system is located between the N and K Reactor Areas. The treatability test is scheduled to run for three to six months, with a report expected by March 2006. If the approach proves successful, it may be deployed in other parts of Hanford's 100 Areas. ■

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